

# NATIONAL BUREAU OF STANDARDS REPORT

3202

INTERLABORATORY INTERCOMPARISONS  
OF  
100-WATT GAS-FILLED  
TUNGSTEN-FILAMENT LAMPS

By  
Ray P. Teele



U. S. DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS

U. S. DEPARTMENT OF COMMERCE

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NATIONAL BUREAU OF STANDARDS

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The scope of activities of the National Bureau of Standards is suggested in the following listing of the divisions and sections engaged in technical work. In general, each section is engaged in specialized research, development, and engineering in the field indicated by its title. A brief description of the activities, and of the resultant reports and publications, appears on the inside of the back cover of this report.

**Electricity.** Resistance and Reactance Measurements. Electrical Instruments. Magnetic Measurements. Electrochemistry.

**Optics and Metrology.** Photometry and Colorimetry. Optical Instruments. Photographic Technology. Length. Engineering Metrology.

**Heat and Power.** Temperature Measurements. Thermodynamics. Cryogenic Physics. Engines and Lubrication. Engine Fuels. Cryogenic Engineering.

**Atomic and Radiation Physics.** Spectroscopy. Radiometry. Mass Spectrometry. Solid State Physics. Electron Physics. Atomic Physics. Neutron Measurements. Infrared Spectroscopy. Nuclear Physics. Radioactivity. X-Ray. Betatron. Nucleonic Instrumentation. Radiological Equipment. Atomic Energy Commission Radiation Instruments Branch.

**Chemistry.** Organic Coatings. Surface Chemistry. Organic Chemistry. Analytical Chemistry. Inorganic Chemistry. Electrodeposition. Gas Chemistry. Physical Chemistry. Thermochemistry. Spectrochemistry. Pure Substances.

**Mechanics.** Sound. Mechanical Instruments. Fluid Mechanics. Engineering Mechanics. Mass and Scale. Capacity, Density, and Fluid Meters. Combustion Control.

**Organic and Fibrous Materials.** Rubber. Textiles. Paper. Leather. Testing and Specifications. Polymer Structure. Organic Plastics. Dental Research.

**Metallurgy.** Thermal Metallurgy. Chemical Metallurgy. Mechanical Metallurgy. Corrosion.

**Mineral Products.** Porcelain and Pottery. Glass. Refractories. Enameled Metals. Concreting Materials. Constitution and Microstructure.

**Building Technology.** Structural Engineering. Fire Protection. Heating and Air Conditioning. Floor, Roof, and Wall Coverings. Codes and Specifications.

**Applied Mathematics.** Numerical Analysis. Computation. Statistical Engineering.

**Electronics.** Engineering Electronics. Electron Tubes. Electronic Computers. Electronic Instrumentation. Process Technology.

**Radio Propagation.** Upper Atmosphere Research. Ionospheric Research. Regular Propagation Services. Frequency Utilization Research. Tropospheric Propagation Research. High Frequency Standards. Microwave Standards.

● Office of Basic Instrumentation

● Office of Weights and Measures.

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NBS PROJECT

NBS REPORT

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INTERLABORATORY INTERCOMPARISONS

OF

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By

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Photometry and Colorimetry Section  
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ABSTRACT

A group of twelve 100-watt gas-filled, tungsten-filament lamps were measured at one laboratory and at the National Bureau of Standards for luminous flux before and at the NBS after circulation to the participating laboratories. The twelve lamps were divided into two groups of six lamps each, one group remaining at the NBS after the first measurements to serve as a control group, the other six lamps being circulated to the various laboratories. The average of the luminous flux of the four surviving lamps of the six lamps circulated was 1612 lumens and the maximum departure of any laboratory was just under 1 percent, the average deviation being 0.5 percent.

I. INTRODUCTION

This intercomparison was undertaken to determine the uniformity of measurements of luminous flux for this type and size of lamp at the participating laboratories. The laboratories participating and the order of reading are as follows:

1. General Electric Company
2. National Bureau of Standards
3. Westinghouse Lamp Division
4. Electrical Testing Laboratories, Inc.
5. Sylvania Electric Products Inc.
6. Champion Lamp Works
7. National Bureau of Standards

The order of reading was chosen to reduce shipment of the lamps as much as possible. Each laboratory followed its own customary procedure in making the measurements.

II. MEASUREMENTS FOR THE CONTROL GROUP

The values of voltage, current, and luminous flux for the un-circulated control group of six lamps are given in Table I. The General Electric Company measured all of the lamps prior to shipment to the NBS.





Table I. Values for the Control Group

Lamp Number	Volts (Set)	GE		NBS			
		Amps	Lumens	1st		2nd	
				Amps	Lumens	Amps	Lumens
NBS3158	120.0	0.8158	1589	0.8146	1589	0.8138	1586
NBS3160	120.0	.8148	1600	.8142	1601	.8127	1591
NBS3161	120.0	.8151	1597	.8144	1600	.8150	1597
NBS3162	120.0	.8180	1622	.8164	1623	.8158	1617
NBS3165	120.0	.8217	1628	.8210	1630	.8208	1634
NBS3166	120.0	.8166	1602	.8166	1608	.8160	1610
Average		0.8170	1606	0.8162	1608	0.8157	1606

The results given in Table I indicate that no change occurred in the control group during the intercomparison.

### III. MEASUREMENTS FOR THE CIRCULATED GROUP

The values of voltage, current, and luminous flux obtained at each of the participating laboratories are given in Table II. The laboratories are arranged in the order in which the lamps were measured.

Table II. Values for the Circulated Group

Lamp Number	Volts (Set)	Lumens						
		GE	NBS	West.	ETL	Sylvania	Champion	NBS
NBS3155	120.0	1594	1603	1609	Broken			
NBS3156	120.0	1585	1596	1603	1575	1586	1583	1578
NBS3157	120.0	1582	1592	Broken				
NBS3159	120.0	1614	1597	1632	1610	1630	1617	1618
NBS3163	120.0	1610	1617	1644	1625	1644	1634	1625
NBS3164	120.0	1610	1603	1632	1615	1626	1612	1611
Average of all		1599	1601	1624 (5)	—	—	—	—
Average of four		1605	1603	1628	1606	1622	1612	1608
Mean of four for all laboratories				1612				





Table II. (Cont'd) Values for the Circulated Group

Lamp Number	Volts (set)	Amperes						
		GE	NBS	West.	ETL	Sylvania	Champ.	NBS
NBS3155	120.0	0.8120	0.8122	0.8105	Broken			
NBS3156	120.0	.8201	.8204	.8174	0.817	0.819	0.830	0.8178
NBS3157	120.0	.8145	.8144	Broken				
NBS3159	120.0	.8182	.8146	.8152	.816	.818	.827	.8170
NBS3163	120.0	.8173	.8166	.8172	.818	.819	.829	.8177
NBS3164	120.0	.8181	.8164	.8152	.818	.818	.829	.8170
Average of all		.8167	.8158	.8151(5)	—	—	—	
Average of four		.8184	.8170	.8162	.817 <sub>2</sub>	.818 <sub>5</sub>	.828 <sub>8</sub>	.8174

#### IV. SUMMARY

There is no indication of any significant change in luminous flux having occurred in either the control or circulated group during the intercomparison. Four of the six participating laboratories are in close agreement on the value of luminous flux for the average of the four surviving lamps; the values being 1605, 1606, 1606, and 1612 (Mean of 1607). Two of the six laboratories depart by an important amount from these four laboratories and in the same direction, both of them obtaining higher values for the luminous flux of the average of the four remaining lamps of the circulated group.

One laboratory reported currents that were not in agreement with those measured at the other five laboratories.

It is felt that this intercomparison will enable the participating laboratories to bring their results into agreement on a sound common basis.

In connection with the results on these lamps it may be of interest to note that the 1950-1952 international intercomparisons carried out at the International Bureau of Weights and Measures in Paris showed that the relative value of the unit of luminous flux at 2788°K, as realized at the NBS, was 0.997<sup>1</sup> when the mean of the five participating laboratories is considered to be unity.

<sup>1</sup>

Rapport sur la Deuxieme Comparaison des Étalons Nationaux d'Intensité et de Flux Lumineux (1950-1952) par J. Terrien et H. Moreau.



## THE NATIONAL BUREAU OF STANDARDS

### Functions and Activities

The functions of the National Bureau of Standards are set forth in the Act of Congress, March 3, 1901, as amended by Congress in Public Law 619, 1950. These include the development and maintenance of the national standards of measurement and the provision of means and methods for making measurements consistent with these standards; the determination of physical constants and properties of materials; the development of methods and instruments for testing materials, devices, and structures; advisory services to Government Agencies on scientific and technical problems; invention and development of devices to serve special needs of the Government; and the development of standard practices, codes, and specifications. The work includes basic and applied research, development, engineering, instrumentation, testing, evaluation, calibration services, and various consultation and information services. A major portion of the Bureau's work is performed for other Government Agencies, particularly the Department of Defense and the Atomic Energy Commission. The scope of activities is suggested by the listing of divisions and sections on the inside of the front cover.

### Reports and Publications

The results of the Bureau's work take the form of either actual equipment and devices or published papers and reports. Reports are issued to the sponsoring agency of a particular project or program. Published papers appear either in the Bureau's own series of publications or in the journals of professional and scientific societies. The Bureau itself publishes three monthly periodicals, available from the Government Printing Office: The Journal of Research, which presents complete papers reporting technical investigations; the Technical News Bulletin, which presents summary and preliminary reports on work in progress; and Basic Radio Propagation Predictions, which provides data for determining the best frequencies to use for radio communications throughout the world. There are also five series of nonperiodical publications: The Applied Mathematics Series, Circulars, Handbooks, Building Materials and Structures Reports, and Miscellaneous Publications.

Information on the Bureau's publications can be found in NBS Circular 460, Publications of the National Bureau of Standards (\$1.00). Information on calibration services and fees can be found in NBS Circular 483, Testing by the National Bureau of Standards (25 cents). Both are available from the Government Printing Office. Inquiries regarding the Bureau's reports and publications should be addressed to the Office of Scientific Publications, National Bureau of Standards, Washington 25, D. C.

